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Technical Specification 35-1

Issue 6 2014

Distribution transformers

Part 1 Common clauses

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PUBLISHING AND COPYRIGHT INFORMATION

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Amendments since publication

Issue	Date	Amendment
Issue 6	2014	Major revision to reflect significant changes to the IEC 60076 series of Standards and to make ENA TS 35-1 a multi-part specification. This issue includes the following principal technical changes: Foreword: amended to reflect splitting of document into multi-part documents. Clause numbering and titles amended throughout to align with 60076-1:2011. Document structure amended to the requirements of ENA ER G0. Scope: Amended to reflect splitting of the documents. 36 kV voltage included in scope but only for pole mounted transformers. Clause 2: Normative references restructured and updated. Those references listed in IEC 60076-1 Clause 2 are not repeated in ENA TS 35-1. Reference to Ecodesign Regulations added. Clause 3: Definitions of transformer types amended to reflect changes in terminology. Clause 4: New clause added to align with IEC 60076-1. Clause 5: Significant changes to align with clause headings and numbering in IEC 60076-1. Clauses 5.1.3 and Clauses 5.2 to 5.8 are new. Clause 6: Requirement added to specify CFVV tapping voltage variation for all transformers unless otherwise stated. Wording changed in Clause 6.3. Clause 6.4 content has been moved to Parts 2, 3 and 4. Table 1: New voltage ratios added for 33 kV. Alternate ratings added for

		example, 160 kVA and new column added to stipulate the connection symbols/vector groups. New impedance values added for 33 kV pole mounted transformers. Clause 6.6: Amended to include provisions of Ecodesign Regulations. Clause 8: New Clause 8.1 added. Clause 8.3 amended to reflect changes in IEC 60076-1. Clause 9: Title change and new Clauses 9.1, 9.4 and 9.5 added to reflect changes in IEC 60076-1. The requirement for centre of gravity marking is now excluded for 50 kVA or smaller single-phase pole mounted transformers in Clause 9.5. Clause 9.2 wording has been amended to clarify the neutral connection requirement. Clause 11: Significant changes to testing clauses to align with IEC 60076-1 and IEC 60076-3. Tables 2A and 2B from Issue 5 have been moved to Parts 2, 3 and 4. New Tables 2 and 3 added to Clause 11.1.2 to clarify the testing requirements. Clause 11.1.3 tests have been updated in line with IEC 60076-3. Clause 10.7 from Issue 5 has been deleted as this requirement is covered in Clause 4.2 of IEC 60076-1. New Clauses 11.8 to 11.12 added to align with IEC 60076-1. Clause 14: The content from Clauses 12 and 13 from Issue 5 has been rationalised into one section. Clause 12.2 from Issue 5 has been deleted as this is covered by Clause 5.2. Clause 14.2: Reference to ENA TS 98-1 added. Clause 14.5: The previous Issue 5 Clauses 13.4.2 ‘Oil level Indication’ and 13.4.4 ‘Jacking lugs’ have been moved to Parts 2 and 3. Clause 14.5.2 has been amended. Clause 14.5.3 has been amended to include reference to BS EN 50216-4. Previous Issue 5 Clause 13.4.6 ‘Combined drain and sampling valve’ has been moved to Parts 2 and 3. Previous Issue 5 Clause 13.4.9 ‘Centre of Gravity’ has been moved to Clause 9.5. Clause 15: The requirement to provide paper copies of documentation has been removed. The requirement to provide type test data or factory test data has been moved to a new Clause 15.2. Figures: Figures not referred in Part 1 have been moved to Parts 2, 3 and 4. Figures 2 and 3 have been redrawn. Annex A: Self-Certification Conformance Declaration significantly amended to reflect changes to clause headings, content and new clauses. Bibliography: New references added including the addition of BS EN 50464-1. Details of all other technical, general and editorial amendments are included in the associated Document Amendment Summary for this Issue (available on request from the Operations Directorate of ENA).

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Foreword

This Technical Specification (TS) is published by the Energy Networks Association (ENA) and comes into effect from date of publication. It has been prepared under the authority of the ENA Engineering Policy and Standards Manager and has been approved for publication by the ENA Electricity Networks and Futures Group (ENFG). The approved abbreviated title of this engineering document is “ENA TS 35-1 Part 1”.

This document replaces and supersedes Technical Specification 35-1 Issue 5 2007.

This Technical Specification has been prepared by the Energy Networks Association.

ENA TS 35-1 is a suite of engineering documents that sets out ENA Member Company requirements for specification of distribution transformers. ENA TS 35-1 has been restructured as a multi-part document to provide better clarity for manufacturers of common requirements and specific requirements for particular types of distribution transformers.

ENA TS 35-1 comprises of the following parts.

- Part 1 – Common clauses.
- Part 2 – Ground mounted transformers—not close-coupled.
- Part 3 – Ground mounted transformers—close-coupled.
- Part 4 – Pole mounted transformers.

Parts 2 to 4 are specific to particular types of transformer and shall be read in conjunction with Part 1 to ascertain all relevant requirements.

Transformers covered by this Technical Specification shall comply with the International and British Standards listed. This Technical Specification amplifies and/or clarifies the requirements of IEC 60076 where alternative arrangements are permitted and where additional information is required. The Technical Specification shall be read, therefore, in conjunction with IEC 60076-1. Those clauses within Part 1 which mirror the requirements of the associated IEC 60076-1 clause, are displayed in grey font to assist the reader.

Part 1 of the Specification includes clauses applicable to all transformers, and clause numbering to the second level is in accordance with IEC 60076-1. The document structure within Part 1 has been designed to mirror that of IEC 60076-1 (Issued 2011). All references to IEC 60076-1 shall be to the year 2011 issue only.

Annex A of the document includes ‘Self Certification Conformance Declaration’ sheets to enable manufacturers to declare conformance or otherwise, clause by clause, with the relevant parts of the document. Manufacturers should refer to the Schedule of Requirements submitted by the purchaser as outlined in Annex B of Parts 2 to 4.

Quality assurance

Quality assurance schemes shall be in accordance with ISO 9001:2008 Quality Management Systems – Requirements.

1 Scope

This Specification applies to transformers in the range 16 kVA to 2 000 kVA for continuous service at 50 Hz, for highest voltage for equipment 7.2 kV, 12 kV, 24 kV and 36 kV[1].

This document is one of the following suite of documents governing the specification of distribution transformers.

- Common clauses (TS 35-1 Part 1).
- Ground mounted transformers—not close-coupled (TS 35-1 Part 2).
- Ground mounted transformers—close-coupled (TS 35-1 Part 3).
- Pole mounted transformers (TS 35-1 Part 4).

This document applies to single-phase and three-phase, two-winding, liquid-immersed, naturally cooled transformers suitable in all respects for indoor or outdoor service connected by oil/air bushings, oil/oil bushings or bushings into cable boxes or separable connectors.

This document presents the requirements which must be satisfied for all transformer types.

2 Normative references

The following referenced documents, in whole or part, are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Standards publications

Clause 2 of IEC 60076-1 is applicable, along with the following additions:

IEC 60076-1:2011, *Power transformers, Part 1: General*

IEC 60422:2005, *Supervision and maintenance guide for mineral insulating oils in electrical equipment*

IEC 60616:1978, *Terminal and tapping markings for power transformers*

IEC 61099:2010*, Specification for unused synthetic organic esters for electrical purposes*

BS EN ISO 780:1999, *Pictorial marking for handling of goods*

BS EN ISO 12944-2:1998, *Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Classification of environments*

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[1] Equipment voltage above 24 kV is considered for use on pole mounted transformers only.

BS EN 50216-3:2002, *Power transformer and reactor fittings – Protective relay for hermetically sealed liquid-immersed transformers and reactors without gaseous cushion*

BS EN 50216-4:2002, *Power transformer and reactor fittings – Basic accessories (earthing terminal, drain and filling devices, thermometer pocket, wheel assembly)*

BS EN 50216-6:2002, *Power transformer and reactor fittings – Cooling equipment – Removable radiators for oil-immersed transformers*

BS EN 50532:2010, *Compact equipment assembly for distribution substations (CEADS)*

BS EN 62271-1:2008+A1:2011, *High-voltage switchgear and control gear*

Other publications

[N1] ENA TS 98-1, *Environmental classification and corrosion protection of structures, plant and equipment*

[N2] DIRECTIVE 2009/125/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing a framework for the setting of ecodesign requirements for energy-related products

[N3] COMMISSION REGULATION (EU) No 548/201 on implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to small, medium and large power transformers

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
General
The definitions as described in IEC 60076-1, Clause 3.1 shall apply.

3.2
Terminals and neutral point
The definitions as described in IEC 60076-1, Clause 3.2 and all sub-clauses shall apply.

3.3
Windings
The definitions as described in IEC 60076-1, Clause 3.3 and all sub-clauses shall apply.

3.4
Rating
The definitions as described in IEC 60076-1, Clause 3.4 and all sub-clauses shall apply.

3.5
Tappings
The definitions as described in IEC 60076-1, Clause 3.5 and all sub-clauses apply.